

REMARKS

Claims 1-6 and 8-20 were examined and reported in the Office Action. Claims 1-6 and 8-20 are rejected. In the instant response, Claims 1-9 are amended, no claims are cancelled and no claims are added. Claims 1-6 and 8-20 are pending. Applicant requests reconsideration of the application in view of the following amendments and remarks.

The instant application is directed to a method for forming a device isolation layer of a semiconductor device, comprising the steps of, forming a pad layer pattern defining a device isolation layer on a substrate, wherein the pad layer pattern includes a pad oxide layer and a pad nitride layer, forming a trench by etching an exposed portion of the substrate with use of the pad layer pattern as a mask, performing an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas, forming a lateral oxide layer on a partial surface of the substrate, the partial surface consisting of sidewalls and a bottom area in the trench by a dry oxidation technique, wherein the dry oxidation technique oxidates the sidewalls and bottom area in the trench formed by the etching process, forming a liner nitride layer on the lateral oxide layer, forming an insulation layer on the liner nitride layer to fill the trench; and planarizing the insulation layer until the pad nitride layer is removed; and removing the pad oxide layer.

I. Claim Amendments

In the instant response, Claims 1 and 9 are amended to particularly point out and distinctly claim the subject matter of the present invention without adding any new matter. In particular, independent Claim 1 is amended to recite “the pad layer pattern includes a pad oxide layer and a pad nitride layer” and “planarizing the insulation layer until the pad nitride layer is removed; and removing the pad oxide layer.” Support for the amendments to Claim 1 may be found, for example, on page 9, lines 3-5 and page 14, lines 1-15; Figure 2F. Claim 9 is amended to recite “forming a pad oxide layer and a pad nitride layer defining a device isolation layer on a substrate” and “planarizing the insulation layer until the pad nitride layer is removed, removing

the pad oxide layer until a surface of the substrate is exposed.” Support for the amendments to Claim 9 may be found, for example, on page 9, lines 3-5 and page 14, lines 1-15.

In view of the foregoing, Applicant respectfully submits the amendments place the claims in condition for allowance and are supported by the specification. Since the amendments do not add new matter, Applicant respectfully requests consideration and entry of the amendments to Claims 1 and 9.

I. Claim Rejections – 35 U.S.C. §103(a)

A. The Examiner rejects Claim 1, 9 and 11 under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent 6,465,866 issued to Park (“Park”), and U. S. Patent 5,801,083 issued to Yu (“Yu”). Applicant respectfully traverses the rejection for at least the following reasons.

To render a claim obvious, the relied upon references must disclose every limitation of the claim such that the invention as a whole would have been obvious at the time the invention was made to one skilled in the art. MPEP §2143. Furthermore, there must be a showing of suggestion or motivation to modify or combine the teachings of those references. *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998).

Applicant respectfully submits the references, alone or in combination, fail to teach or suggest a method of fabricating a semiconductor device including the elements of forming a pad layer pattern defining a device isolation layer on a substrate wherein the pad layer pattern includes a pad oxide layer and a pad nitride layer, forming a trench by etching an exposed portion of the substrate with use of the pad layer as a mask, performing an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas, forming a lateral oxide layer by dry oxidation technique oxidating sidewalls and a bottom area in the trench formed by the etching process, forming a liner nitride layer on the lateral oxide layer, forming an insulation layer on the liner nitride layer to fill the trench, planarizing the insulation layer until the pad nitride layer is removed and removing the pad oxide layer.

The Examiner alleges Park teaches each of the elements of Claims 1 and 9 except for performing an etching process to make top corners of the trench rounded by controlling an angle

of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas. The Examiner instead relies upon Yu to teach this element stating that Yu teaches an etching process to make top corners of the trench rounded using a contained quantity of hydrogen bromide and chlorine gas. See Action, page 3. The Examiner alleges it would have been obvious to one skilled in the art to incorporate these features of Yu into that of Park because the tapered or sloped edge of the trench can be controlled by the etching conditions as taught in Yu. See Action, page 3.

Applicant respectfully disagrees with the Examiner's reliance on this portion of Yu to teach rounded top corners using a contained quantity of hydrogen bromide and chlorine gas. Yu teaches that use of the etchant disclosed results in a sloped trench without any corners (see Fig. 3) due to the presence of an overlying polymer spacer 6b. See Yu, col. 3, lines 40-45. Once the polymer spacer 6b is removed, an unetched space underlying spacer 6b which has a sharp corner 8a is found. See Yu, col. 3, lines 45-47. As illustrated in Figure 5, a silicon dioxide layer 9 is then applied over corner 8a to create a rounded corner. Thus this portion of Yu does not teach an etching process using a contained quantity of hydrogen bromide and chlorine gas in an etching gas to round the trench corners. Accordingly, the Examiner has not pointed to a portion of either of the references teaching or suggesting the element of performing an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas as recited in Claims 1 and 9.

The Examiner has further not pointed to, and Applicant is unable to discern, a portion of the references teaching the element of "planarizing the insulation layer until the pad nitride layer is removed and removing the pad oxide layer" as recited in the amendments to Claims 1 and 9. The Examiner alleges Park teaches planarizing the insulation layer (Figure 5D, column 3, lines 22-23) but as can be seen from the figure, a pad nitride film 44 still remains. Thus, Park does not teach that the insulation layer is planarized until the pad nitride layer is removed and the pad oxide layer removed until the substrate is exposed as recited in Claims 1 and 9. Applicant is unable to discern a portion of Yu curing the deficiencies of Park with respect to this element.

Still further, the Examiner has not pointed to, and Applicant is unable to discern, a portion of the references expressly disclosing the element of “wherein the pad layer pattern includes a pad oxide layer and a pad nitride layer” as recited in the amendments to Claim 1. Thus, for at least these additional reasons, the Examiner has not shown Claim 1 is obvious over Park in view of Yu.

Thus, for at least the foregoing reasons, the Examiner has not shown that the references, alone or in combination, teach or suggest each and every element of Claims 1 and 9. Since each and every element of the claims is not found in the references, a *prima facie* case of obviousness may not be established. Thus, for at least the foregoing reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 1 and 9 under 35 U.S.C. 103(a).

In regard to Claim 11, Claim 11 depends from Claim 9 and incorporates the limitations thereof. Thus, for at least the reasons mentioned in regard to Claim 9, Claim 11 is not *prima facie* obvious over Park in view of Yu. Thus, for at least the foregoing reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claim 11 under 35 U.S.C. 103(a).

B. The Examiner rejects Claims 2, 4, 5, 8, 13, 16, 18 and 19 under 35 U.S.C. 103(a) as being unpatentable over Park and Yu as applied to Claims 1, 9 and 11 above, and further in view of U. S. Patent 6,180,466 issued to Ibok. Applicant respectfully traverses the rejection for at least the following reasons.

In regard to Claims 2 and 5, these claims depend from Claim 1 and incorporate the limitations thereof. In regard to Claims 16 and 19, these claims depend from Claim 9 and incorporate the limitations thereof. Thus, for at least the reasons previously discussed in regard to Claims 1 and 9, Park and Yu may not be relied upon to teach each and every element of Claims 2, 5, 16 and 19. Applicant is further unable to discern a portion of Ibok curing the deficiencies of Park and Yu at least with respect to the elements of performing an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas, planarizing the insulation layer until the pad nitride layer is removed, and removing the pad oxide layer as found in Claims 2, 5, 16 and 19. Thus, for at least the foregoing reasons, Claims 2, 5, 16

and 19 are not *prima facie* obvious over Park, Yu and Ibok. In view of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the rejection to Claims 2, 5, 16 and 19 under 35 U.S.C. 103.

In regard to Claims 8 and 13, Claims 8 and 13 depend from Claims 1 and 9 respectively and incorporate the limitations thereof. Thus, for at least the reasons previously discussed, Park, Yu and Ibok fail to teach or suggest each and every element of Claims 8 and 13. Claims 8 and 13 further recite the element of wherein the dry oxidation technique is performed at a temperature of about 900°C to about 1000°C to form the lateral oxide layer with a thickness ranging from about 60 Å to about 100 Å. The Examiner alleges Ibok teaches a dry oxidation technique performed at the recited temperature however does not point to a portion of Ibok teaching the lateral oxide layer with a thickness ranging from about 60 Å to about 100 Å. In the previous Action, the Examiner alleged it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See Action, page 8. Applicant respectfully disagrees with the Examiner's conclusion for at least the reason that the Examiner has not pointed to a portion of the references expressly teaching use of the dry oxidation technique at a controlled temperature of about 900°C to about 100°C to achieve formation of the lateral oxide layer having a desired thickness. In particular, the portion of Ibok cited by the Examiner, namely col. 2, lines 15-16, teaches a conventional temperature range of about 950°C and above 1100°C is undesirable as it may be costly and reduce production throughput. See Ibok, col. 2, lines 30-40. Moreover, Ibok does not suggest that using the undesirable temperature range would result in a lateral oxide layer with a thickness ranging from about 60 Å to about 100 Å. Thus, not only does Ibok teach away from Applicant's claimed temperature range but Ibok, there is no indication from the reference that the temperature range will achieve the claimed oxide layer thickness. Accordingly, upon viewing the teachings of Ibok, one of ordinary skill in the art would not recognize a desire to modify Park to include a dry oxidation technique performed at a temperature of about 900°C to about 100°C to form a lateral oxide layer with a thickness ranging from about 60 Å to about 100 Å. Thus, for at least the foregoing reasons, neither Park, Yu nor Ibok teach or suggest each and every element of Claims 8 and 13. In view of the foregoing, a *prima facie* case of obviousness may not be established. Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 8 and 13 under 35

U.S.C. §103.

In regard to Claims 4 and 18, Claims 4 and 18 depend from Claims 1 and 9 respectively, and incorporate the limitations thereof. As previously discussed, neither Park, Yu nor Ibok teach or suggest each and every element of Claims 1 and 9. Thus, Claims 4 and 18 are further not obvious in view of the references. Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 4 and 18 under 35 U.S.C. §103.

C. The Examiner rejects Claims 3 and 17 under 35 U.S.C. 103(a) as being unpatentable over Park, Yu and Ibok as applied to Claims 2 and 16 above and U. S. Patent 2003/0092273 issued to Downey (“Downey”). Applicant respectfully traverses the rejection for at least the following reasons.

Claims 3 and 17 depend from Claims 1 and 9 respectively and incorporate the limitations thereof. For at least the reasons previously discussed, the combination of Park, Yu and Ibok fails to teach or suggest each and every element of Claims 1 and 9. The Examiner has not pointed to, and Applicant is unable to discern a portion of Downey curing the deficiencies of Park, Yu and Ibok with respect to each of the elements of Claims 1 and 9 previously discussed. Thus, for at least the reasons that Claims 1 and 9 are not *prima facie* obvious over the references, Claims 3 and 17 are further not obvious. Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 3 and 17 under 35 U.S.C. §103

D. The Examiner rejects Claims 6 and 20 under 35 U.S.C. 103(a) as being unpatentable over Park, Yu and Ibok, and further in view of U.S. Patent 6,225,187 issued to Huang (“Huang”).

Claims 6 and 20 depend from Claims 1 and 9 respectively and incorporate the limitations thereof. Thus, for at least the reasons previously discussed in regard to Claims 1 and 9, Park, Yu and Ibok fail to teach or suggest each and every element as found in Claims 6 and 20. The Examiner has not pointed to, and Applicant is unable to discern a portion of Huang curing the deficiencies of Park, Yu and Ibok with respect to each of the elements of Claims 1 and 9 previously discussed. Thus, for at least the foregoing reasons, neither Park, Yu, Ibok nor Huang, alone or in combination, teach or suggest each and every element of Claims 6 and 20. In view of the foregoing, a *prima facie* case of obviousness may not be established. Applicant respectfully

requests reconsideration and withdrawal of the rejection of Claims 6 and 20 under 35 U.S.C. §103.

E. The Examiner rejects Claims 10, 12 and 14 under 35 U.S.C. 103(a) as being unpatentable over Park and Yu and further in view of U.S. Patent 4,087,832 issued to Jambotkar (“Jambotkar”).

Claims 10, 12 and 14 depend from Claim 9 and incorporate the limitations thereof. Thus, for at least the reasons previously discussed in regard to Claim 9, Park and Yu fail to teach or suggest each and every element as founded in Claims 10, 12 and 14. The Examiner has not pointed to, and Applicant is unable to discern a portion of Jambotkar curing the deficiencies of Park and Yu with respect to each of the elements of Claim 9 previously discussed. Thus, for at least the foregoing reasons, neither Park, Yu nor Jambotkar teach or suggest each and every element of Claims 10, 12 and 14. In view of the foregoing, a *prima facie* case of obviousness may not be established. Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 10, 12 and 14 under 35 U.S.C. §103.

F. The Examiner rejects Claim 15 under 35 U.S.C. 103(a) as being unpatentable over Park, Yu and Jambotkar as applied to Claim 12 above and further in view of Ibok.

Claim 15 depends from Claims 9 and 12 and incorporates the limitations thereof. Thus, for at least the reasons previously discussed in regard to Claims 9 and 12, Park, Yu and Jambotkar fail to teach or suggest each and every element as founded in Claim 15. The Examiner has not pointed to, and Applicant is unable to discern a portion of Jambotkar curing the deficiencies of Park and Yu with respect to each of the elements of Claim 9 previously discussed. Thus, for at least the foregoing reasons, neither Park, Yu nor Jambotkar teach or suggest each and every element of Claim 15. In view of the foregoing, a *prima facie* case of obviousness may not be established. Applicant respectfully requests reconsideration and withdrawal of the rejection of Claim 15 under 35 U.S.C. §103

CONCLUSION

In view of the foregoing, it is believed that all claims now pending, namely Claims 1-6 and 8-20, are now in condition for allowance and such action is earnestly solicited at the earliest possible date. If there are any additional fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. Questions regarding this matter should be directed to the undersigned at (310) 207-3800.

Respectfully submitted,

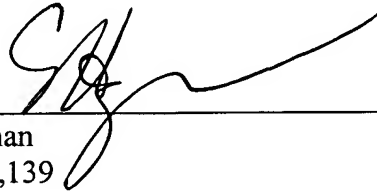
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Dated: _____

7/17/06

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